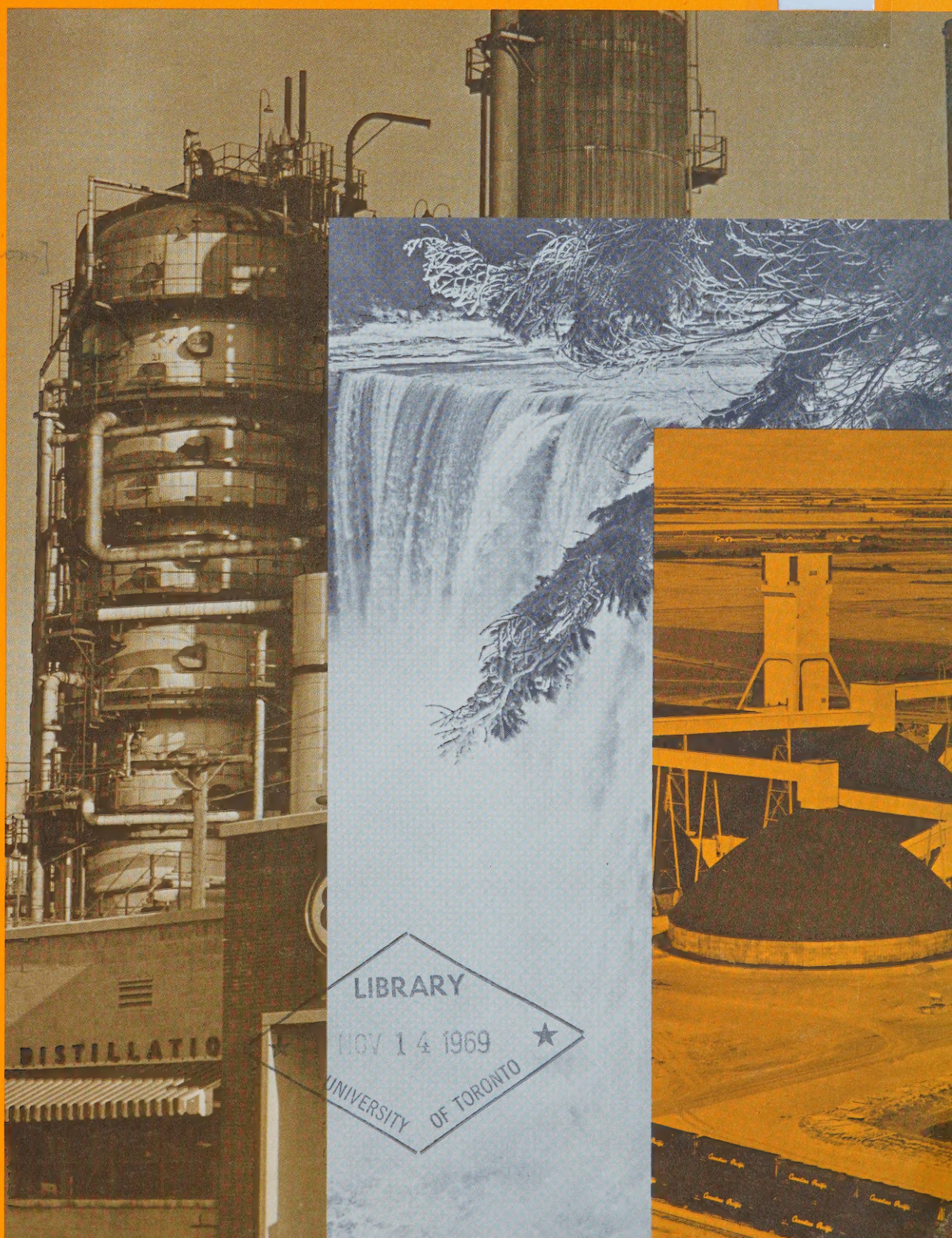
YOUR FUTURE IN SCIENCE AND RESOURCE DEVELOPMENT

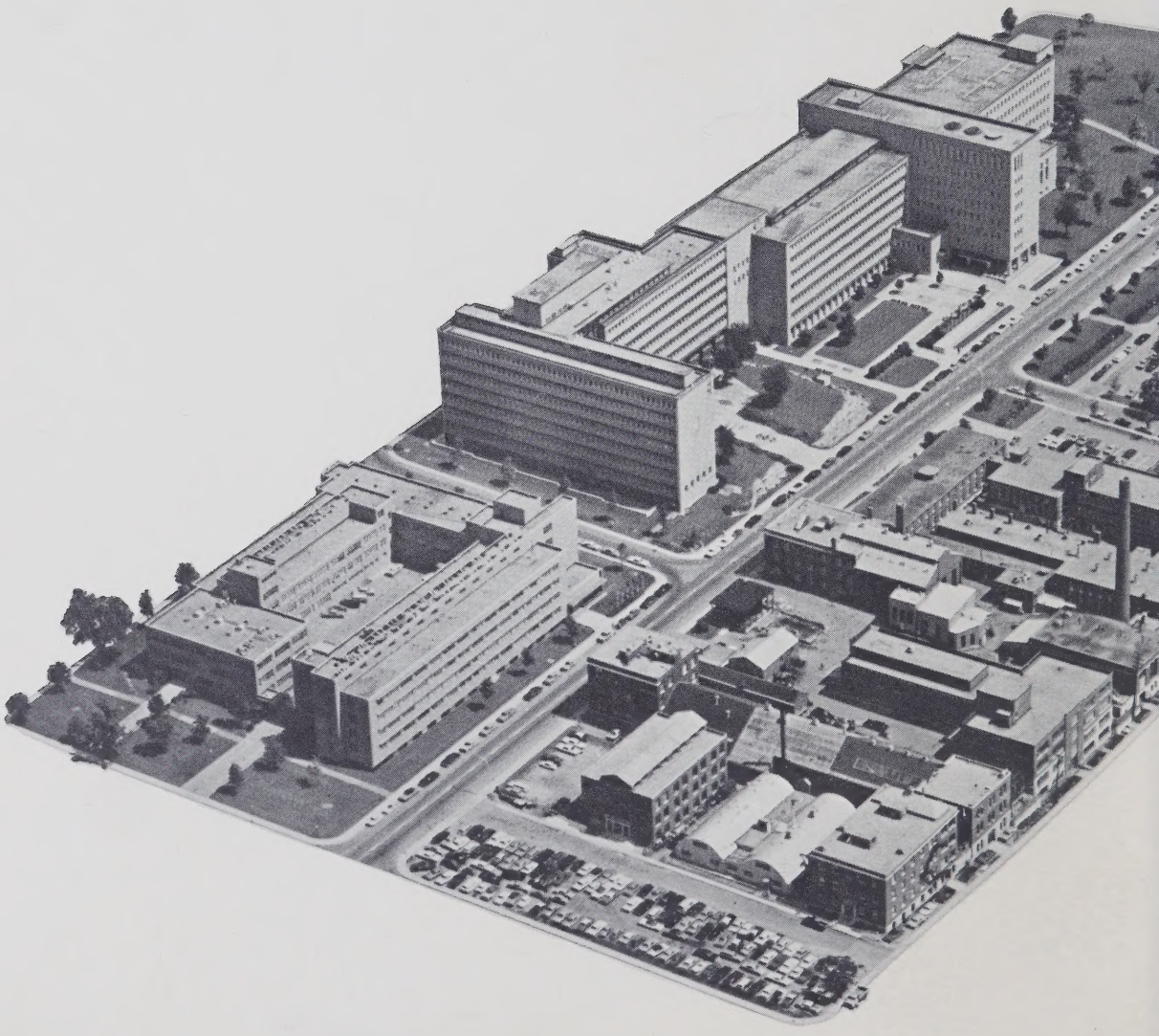
An Introduction to the Department of Energy, Mines and Resources



DEPARTMENT OF ENERGY, MINES AND RESOURCES

This is your introduction to the Department of Energy, Mines and Resources. This booklet tries to fit together the jigsaw puzzle of the many skills and professions that make up the staff of the Department — the oldest government research organization in Canada, and one of the largest and most diversified.

Before describing the work of the various units making up the Department of Energy, Mines and Resources, we ought to answer a few basic questions.



WHAT IS EMR?

The Department of Energy, Mines and Resources — known as EMR — is a branch of the Federal Government. Like all government departments it is headed by a cabinet minister and administered by a deputy minister. The staff of the Department, which comes from every province and from many professions in Canada, is hired through the Public Service Commission.

WHAT IS ITS PURPOSE?

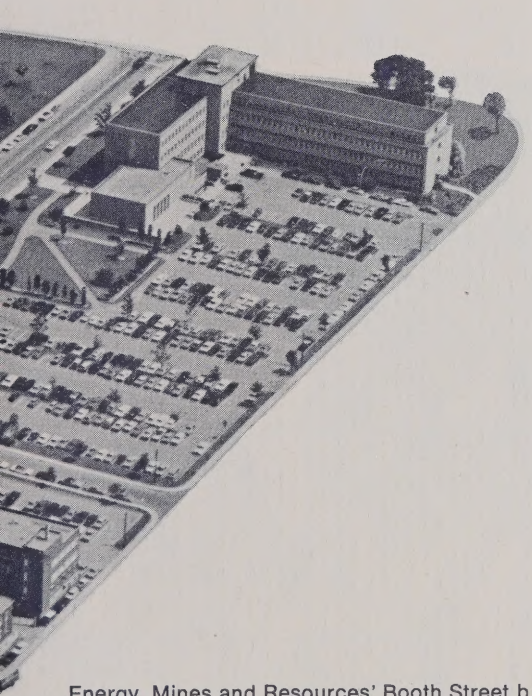
The Department is primarily a scientific and technical organization. Briefly, its purpose is to provide policy advice on such matters as energy, mineral economics, and water use; to survey and map the land and water areas of Canada; to provide technological aid in the processing of mineral resources; to carry out research in geology, astronomy, geophysics, hydrology, limnology, oceanography and related fields and to undertake certain administrative and information work connected with energy and resource development. Insofar as comparisons are valid, the Department's functions resemble in some respects those of the National Research Council, in others those of the Dominion Bureau of Statistics, in still others those of the Department of Agriculture (except that the resources it deals with are chiefly mineral rather than biological).

WHERE IS IT LOCATED?

Most of the Department's offices and laboratories have traditionally been concentrated in Ottawa, and to a large extent this is still true. In recent years, however, there has been a dispersal and a growth of laboratories and other departmental establishments across Canada. The most important of these establishments are the Bedford Institute at Dartmouth, N.S., the Institute of Sedimentary and Petroleum Geology at Calgary, the Canada Centre for Inland Waters at Burlington, Ont. (under construction at this writing), the astronomic and marine-sciences establishments at Victoria, and the geological and water research offices in Vancouver. Smaller departmental offices and laboratories exist in most of the provinces and territories.

Of the Department's permanent staff of approximately 4,500, 75 per cent are stationed in Ottawa. The remaining 25 per cent are stationed across Canada. The provinces with the largest numbers of departmental employees, after Ontario, are Nova Scotia, British Columbia, Alberta, and Manitoba. In addition to the permanent staff there are some 650 ship's crew and, each summer, approximately 300 casual employees.

Being permanently stationed in one of the above-mentioned establishments in Ottawa or elsewhere does not, however, mean that an employee will spend all his working time there, for there is a large seasonal migration of survey and research parties into the field. These parties, which may number up to 400, fan out across the length and breadth of Canada, with particular emphasis on the north. Departmental ships leave on extended scientific and survey cruises.

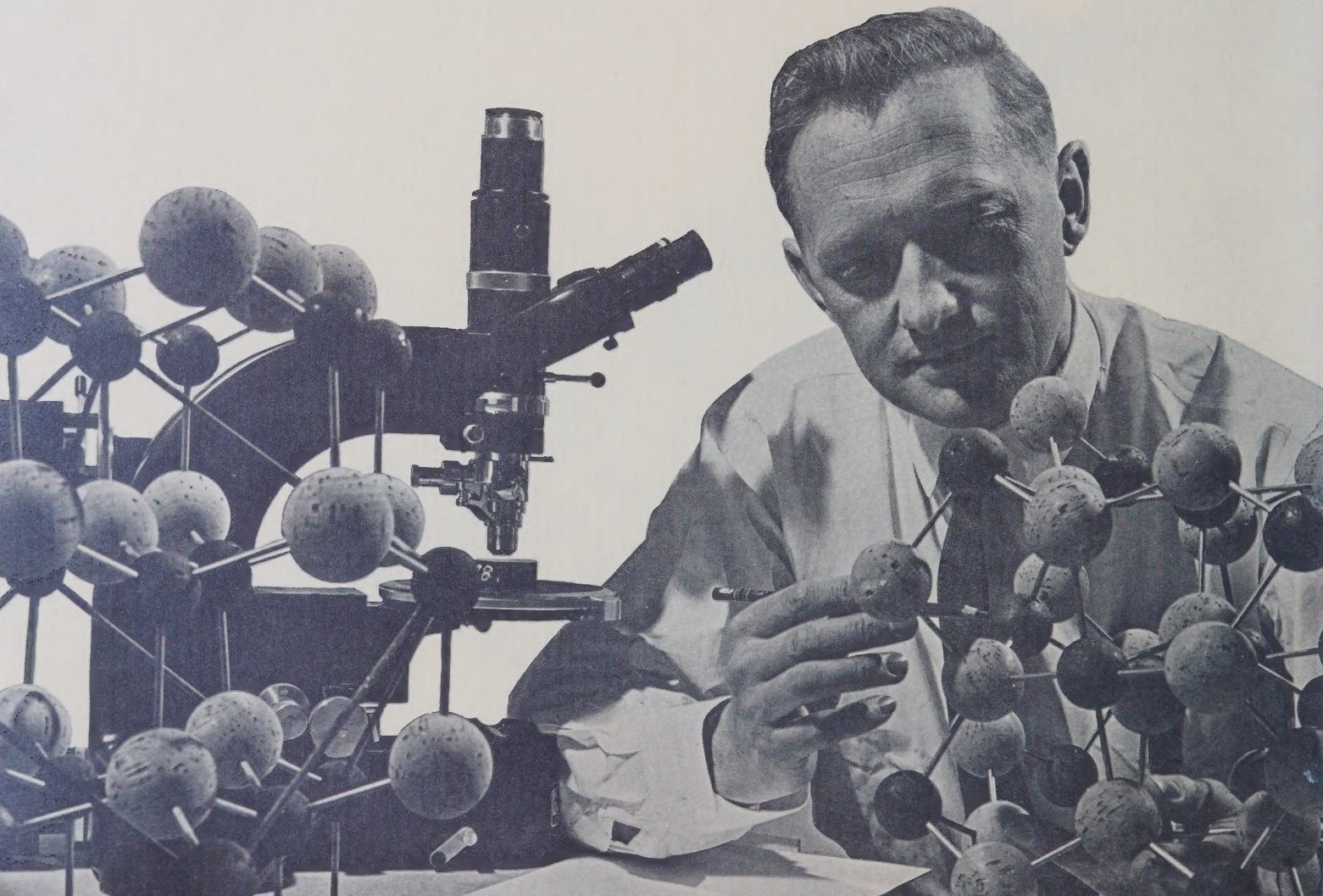


Energy, Mines and Resources' Booth Street buildings, Ottawa.

WHO ARE THE WORKERS?

The Department of Energy, Mines and Resources embodies almost every branch of science and technology, from paleontology to biogeochemistry, from electronic computers to neutron generators, and provides ample scope for numerous professions. It is not surprising that the staff should contain an unusually high proportion of skilled technical and professional employees, and for many research positions a Ph.D. degree is desirable. Laboratory and survey work generally demands persons with special formal training gained before joining the Department. The proportion of administrative and clerical staff is a good deal smaller than in government departments engaged in direct service to the general public. The Department does, of course, have its own administrative units, in which all the standard office occupations are represented, from editor to accountant.

A G.S.C. paleontologist studies fossils from Burgess shale of British Columbia.



Some of E.M.R.'s vital products, maps, charts, aerial photos, are used by science and industry alike.

HOW IS THE DEPARTMENT ORGANIZED?

The Department is subdivided functionally; that is, people pursuing the same or similar research or surveys are grouped together as much as practical, no matter where their work may take them. Thus, although a single departmental building in Calgary may house both geologists and water specialists, each group reports separately to headquarters at Ottawa. Anyone familiar with modern science and technology will appreciate that such groupings can be neither rigid nor permanent, since it is often difficult to predict the need for specific investigations and the degree of inter-disciplinary collaboration such investigations might require.

At this writing, the Department has four main "operational" groups: Mines and Geosciences, Water, Mineral Development, and Energy Development. Mines and Geosciences, by far the largest in terms of staff (61 per cent), consists of the following branches: Surveys and Mapping Branch, Geological Survey of Canada, Mines Branch, Observatories Branch, and Polar Continental Shelf Project. The next-largest group is the Water Group, which consists of three branches — Marine Sciences, Inland Waters and Policy and Planning. The Mineral Development Group is represented chiefly by the Mineral Resources Branch; it also contains the small Explosives Division. The Energy Development Group, still in process of formation, has only a small advisory staff.

To provide the administrative and other ancillary services to the technical and research groups, the Department has an Administration Branch, a Personnel and Organization Branch, a Public Relations and Information Services Branch, and a Computer Science Division.

HOW DOES IT FUNCTION?

Most of the operative units of the Department obtain the raw material for their studies or their maps directly from nature, that is, they "go into the field." This applies particularly to the Surveys and Mapping Branch, the Geological Survey of Canada, the Observatories Branch, the Polar Continental Shelf Project, the Marine Sciences Branch, and the Inland Waters Branch. The Mines Branch obtains most of its information from tests and experiments in plants and laboratories, and observations at work sites. The Policy and Planning Branch in the Water Group, the Mineral Resources Branch, the Explosives Division and the Energy Development Group are engaged mainly in office work.

The atomic structure of minerals can sometimes offer clues leading to the development of new ore-processing methods.

MINES AND GEOSCIENCES

SURVEYS AND MAPPING BRANCH

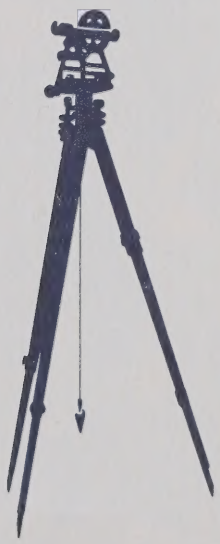
The task of this branch is to take the measure of Canada's land areas and to publish the results in the form of maps and statistical tables.

One of the Branch's divisions, the Geodetic Survey of Canada, provides the basic framework of horizontal and vertical control and the additional control necessary for surveying, mapping and engineering projects. It also carries out investigations into the precise size and shape of the earth and studies horizontal and vertical crustal movement. Each year the Geodetic Survey sends some 30 parties into the field. Its operations have benefitted enormously from the advent of airborne transportation and electronic distance measurement.

The chief task of the Branch's Topographical Surveys Directorate is the plotting of manuscripts for topographical maps, of which the most popular scales are 1:250,000, 1:50,000 and 1:25,000. Since the introduction of complete air-photo coverage before mapping, much of the laborious field mapping has become unnecessary. Modern stereo-plotters can deduce elevations accurately from air photos, and photogrammetry makes the derivation of maps from photographs a routine and efficient operation. The Topographical Surveys Directorate is also responsible for the carrying out of air photography in all provinces and both territories to meet federal government requirements. As it is the prime user of aerial photos, the directorate also handles the sale of these to the public through its National Air Photo Library.

Several distinct functions are grouped within the Legal Surveys Division. It has recently participated in the survey and demarcation of various interprovincial and territorial boundaries in the northwest, and is also entrusted with reviewing the drafts of descriptions of federal electoral districts. It sends out each year fifteen to twenty field parties for surveying in federal lands — townsites and sub-divisions in the Yukon and Northwest Territories, property surveys in Indian Reserves, boundaries of national parks.

A highly specialized unit operating within the Surveys and Mapping Branch is the International Boundary Commission. This small agency, which has a counterpart in the United States federal government, deals with the surveying, demarcation, and maintenance of the 5,526-mile-long Canada-U.S. boundary.



The Topographical Surveys Directorate does not itself take map-making beyond the "manuscript" or rough draft stage. The final drafting and printing of all maps is done in the Map Production Directorate. Its enormous annual output of about one million maps and charts is made possible by photo-mechanical support and the general use of scribing, i.e., engraving designs on coated plastic sheets.

The Directorate also prints maps for many other government agencies, and is without doubt Canada's largest and most-advanced map-printing establishment. It is also the sole agency in Canada for the preparation of aeronautical charts. Much of this type of mapping arises from the necessity to constantly keep up with new aeronautical instrumentation and information.

The distribution of maps and air charts is handled by the Map Distribution Office, which has a stock of about 20 million maps and charts.

The normal academic requirement for a professional career in the Surveys and Mapping Branch is a university degree in mathematics, physics, or civil engineering; however, some jobs are open to holders of provincial land surveyor's certificates.

GEOLOGICAL SURVEY OF CANADA

The Geological Survey of Canada is one of the oldest government agencies in the country; in fact, it antedates Confederation by some 25 years. During its century and a quarter of exploration the Geological Survey has accumulated a large store of knowledge about Canada's mineral resources and a proud tradition of research. Yet so vast is the territory to be surveyed that in many areas, notably in the north, the Survey has literally only begun to scratch the surface.

The Survey does not, of course, follow up indications of mineral or metal occurrences with detailed exploration; this is left to the multitude of private development and mining companies. The Survey's job is to provide geological maps and basic information by which prospectors, exploration companies, and conservation planners can chart their course.

Every summer the Geological Survey sends into the field some 100 parties. A small proportion of these continue the reconnaissance mapping that was formerly the main task of the Survey, while most investigate specific occurrences or problems.

Administratively, the Geological Survey is subdivided into divisions, which are essentially groups of scientists working on related problems or regions. One group is concerned with those regions of the country that have undergone orogenic, or mountain-building, disturbance — the Rockies in the west, the stony Canadian Shield in the centre and north, the Appalachian region in the Atlantic Provinces. Geophysicists specialize in such methods as aeromagnetic surveys, seismicity, the determination of rock magnetism, and others. Petrologists determine the ages of rock by measuring the decay of radioactive isotopes, such as rubidium; they also carry out chemical X-ray analyses of rocks. Others are charged with studying useful mineral deposits, the soil that provides the foundation for our cities and farms, dam and canal sites, and the tracing of mineral deposits by the chemical analysis of soil and plants. Stratigraphers and paleontologists study the fossiliferous rocks in which petroleum, natural gas and coal are found.

This division of labor means that some Geological Survey

of Canada scientists may spend half their year in the field and the other half in the office; while others may work in the office or laboratory the year round.

Modern exploration methods have brought about great changes in geological surveying. Airborne transportation, by fixed-wing aircraft or helicopter, has become the standard in many areas. Geologists also use aircraft for direct survey work, usually with various instruments.

Although most geologists are stationed permanently in Ottawa, there are establishments of the Geological Survey elsewhere in Canada, the largest and most important being the Institute of Sedimentary and Petroleum Geology in Calgary.

The highly specialized knowledge needed for geological research can normally be gained only through lengthy formal education. Even within the Department, the Geological Survey of Canada has a particularly high proportion of university graduates, and most major research positions are occupied by holders of doctorates. In addition to the permanent staff, many student assistants are employed each summer, and to some of these the Survey offers opportunities for postgraduate research. A very considerable number of university theses have been based on such work, and over the years the Geological Survey has played a vital role in the training of Canadian geologists.

Geologists work in many kinds of terrain, some accessible only to a float-equipped plane.

Geologists use many modes of travel including, in this instance, a helicopter.

MINES BRANCH

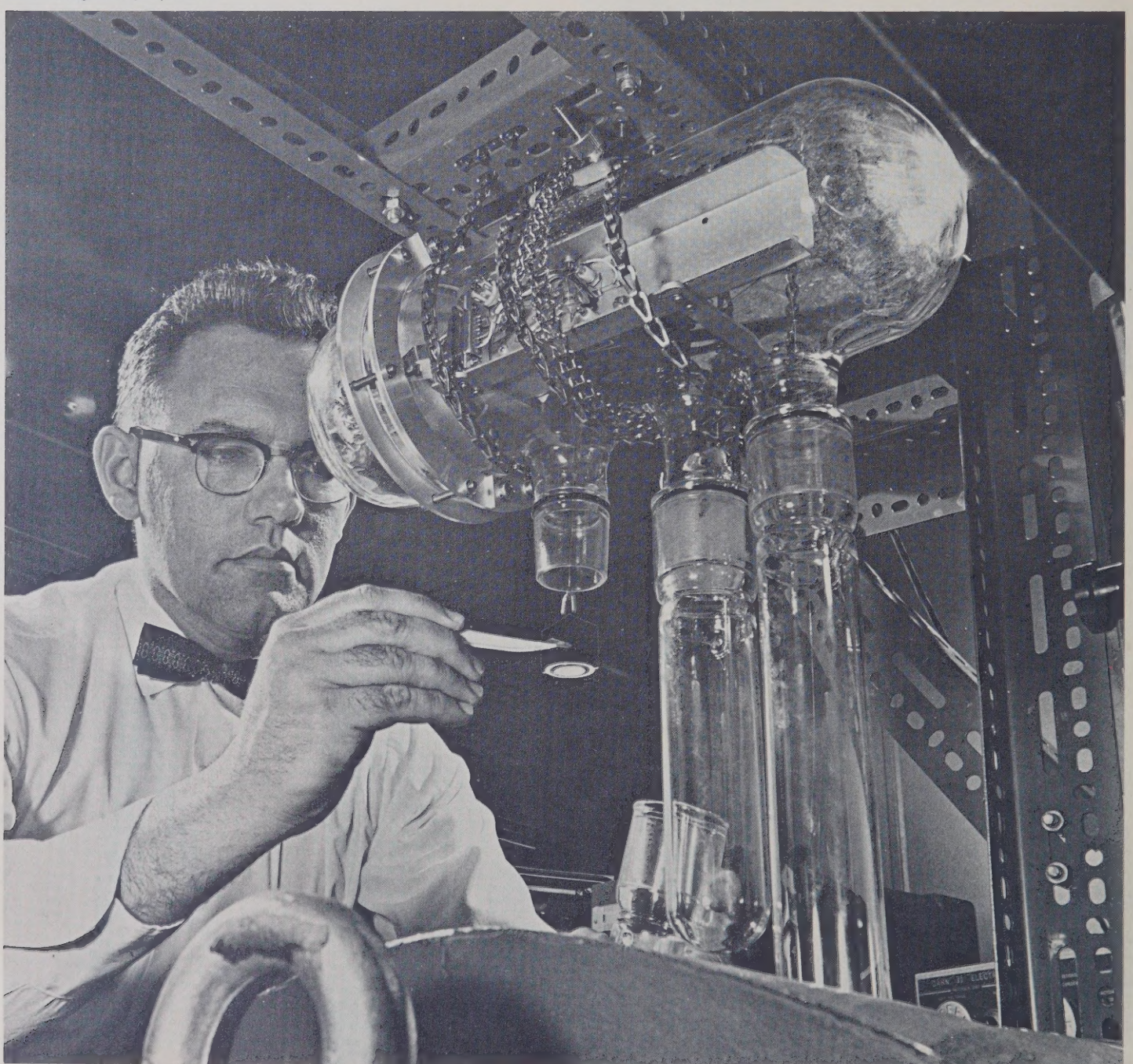
The Mines Branch is, in effect, a comprehensive laboratory complex in which all aspects of the extraction and the processing of mineral resources are studied and improved. "Mineral resources" in this context means the totality of non-biological wealth lying below the soil: gravel, clays, metal ores, petroleum, gas, coal; and "extraction and processing" includes mining practice, milling and concentration of ores, leaching of gold and uranium, the smelting and alloying of metals, the study of metal corrosion and resistance to stress, refining of petroleum, the burning of coal, the production of ceramics — in short, an almost inexhaustible field.

The branch is divided functionally into four research divisions and two research centres, mostly located in Ottawa. There are laboratories at Elliot Lake, Ontario, and at Edmonton, Alberta.

The scientists of the Mineral Processing Division seek economical ways of processing metallic and non-metallic ores by improving present processing methods to make them less expensive or by developing new methods to meet special conditions. They use laboratory and pilot-plant tests on flotation, crushing, gravity concentration, and other methods of treatment. The division also works on the processing and use of industrial minerals such as clay, construction materials, etc.

The Extraction Metallurgy Division helps industry to make efficient use of hydrometallurgical and pyrometallurgical processes in the extraction of metals from ores and concentrates. It works closely with producers of uranium, gold, copper and rare metals such as cesium and niobium, and tries to devise more efficient and economical ways of separating such contained metals from accompanying impurities by acid leaching and cyanidation. In pyrometallurgical processes concentration of metal ore is done by such processes as roasting, sintering, etc., and finally the concentrate is smelted to metal.

A Mines Branch scientist tests a mineral for its magnetic properties.



In the Mineral Sciences Division the latest chemical and physical science and technology are brought to bear on the structure and composition of minerals. The work of the division is pursued along interdisciplinary lines involving mineralogy, chemistry, spectrochemistry, physical chemistry, physics and mathematics, etc. Research in the division provides knowledge on the properties of minerals, pointing to the extraction of metal values from leaner and more complex ores. The various complex instruments are acquired or constructed. The scientists also develop analytical standards and methods for both minerals and metals.

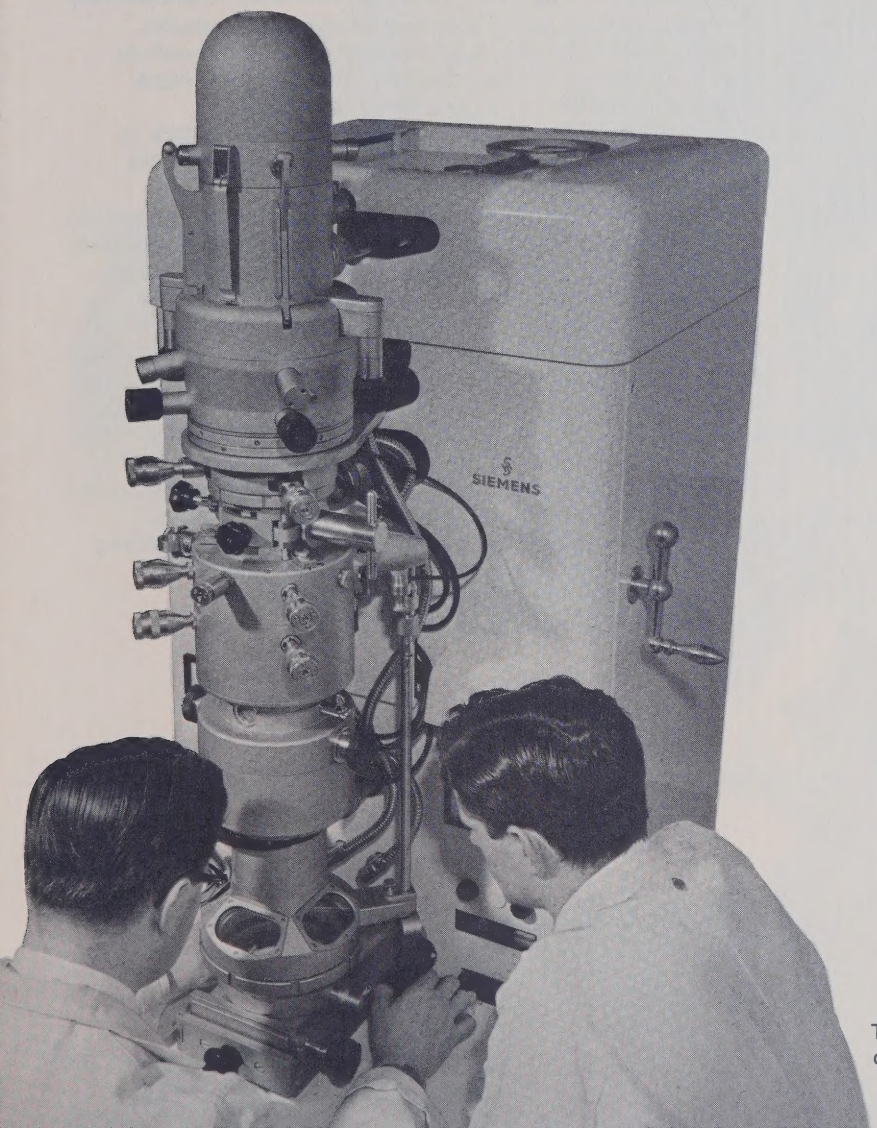
The Fuels Research Centre specialists conduct research in the chemistry of petroleum, the refining of low-grade Canadian crude oils by hydrogenation and catalytic-cracking techniques, as well as the development of catalysts. They experiment with more efficient apparatus for burning coals and oils; for using Canadian coals in metallurgy, as in the form of coke. They also check on the safety of electrical and other equipment in explosive atmospheres, such as are often found in mines. The centre operates a small regional laboratory in Edmonton, Alberta, on research in separating impurities in friable coking coals and in the general fine-particle-separation field.

Scientists of the Mining Research Centre concentrate on rock mechanics and mining technology, seeking to improve the stability of excavations in underground and open-pit mines. They study drilling and blasting of rocks, and underground airborne dust. The Canadian Explosives Research Laboratory is part of the centre, testing commercial explosives for the Department's Explosives Division, and dangerous substances for other departments. The centre maintains a mining research laboratory at Elliot Lake, Ontario.

Research in the Physical Metallurgy Division concentrates on the production of metals and alloys, and on their qualities and applications. Physical metallurgists study the reduction of metal fatigue, better welding techniques, corrosion phenomena, etc., and improvements in the manufacture and treatment of metals. The division receives a large number of samples each year for tests and recommendations.

In their investigations, Mines Branch scientists work with some of the most advanced "space-age" techniques and apparatus. Many of the testing instruments are designed and constructed in the branch itself, and instrumentation research receives much support.

In these diverse activities the Mines Branch employs metallurgists, mining and chemical engineers, physicists and graduate chemists.



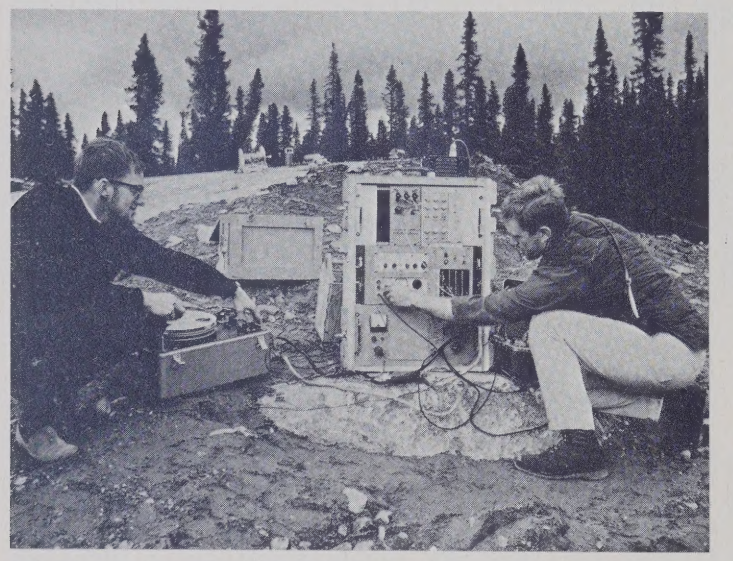
The electron microscope is one of a wide range of instruments used in metals research.

OBSERVATORIES BRANCH

This branch unites within itself two fairly distinct sciences — astronomy and geophysics. Government astronomy in Canada arose late in the nineteenth century primarily to supply the needs of surveying and accurate timekeeping, and geophysics became associated with it largely for practical and personal reasons.

At present the branch operates three principal astronomic observatories in Canada, each with a different field of research.

The Observatory in Ottawa specializes in what might be considered the traditional or original aspects of astronomy. Foremost among them is positional astronomy, or the accurate determination of star positions. Historically allied to this is the observation of the sun and the accurate determination of time. The latter is no longer dependent on the rotation of the earth — which is too irregular for modern technical purposes — but on such fine instruments as the atomic clock. The observatory's own radio transmitter announces accurate time 24 hours a day. Ottawa is also the centre for meteor physics and the study of suspected meteorite craters across Canada. The composition of meteors is deduced mainly from photographs of their spectra. The chief instruments of the Ottawa observatory are a mirror transit circle and a photographic zenith tube.



Seismic crew from Observatories Branch record sound waves from basement rock. The waves are generated by high-explosive charge set off at the bottom of a nearby lake.

The Dominion Astrophysical Observatory at Victoria operates the 50-year-old 72-inch mirror telescope. It is still Canada's largest. Victoria also has a newer 48-inch telescope. The chief occupation of Victoria astronomers is the photographing and interpretation of stellar spectra. Two kinds of information can be obtained from these spectra — the composition of the stars in terms of chemical elements, and the speed with which a star is moving towards or away from the earth. Various deductions can be made from this information, such as the age of stars, the rate of rotation of our galaxy the Milky Way, and the identification of double or multiple stars which are seen as single stars.

A different type of astronomy is pursued at the Dominion Radio Astrophysical Observatory near Penticton, B.C. Here a number of radio telescopes, similar to radar receivers, measure radio waves emanating from cosmic gas clouds and from distant galaxies. (Radio waves emitted by single stars are too weak to be received; the only exception is the sun.) The chief instruments of this observatory are a 25-meter movable parabolic telescope and several fixed T-shaped telescope arrays.

The three geophysics divisions of the Observatories Branch study seismology, gravity and geomagnetism.

The seismologists, who study both natural and man-made earthquakes, have set up a network of seismograph stations with uniform distribution across Canada. The information collected is compiled on earthquake-probability maps for the guidance of builders, insurance companies, and other interested agencies. It also provides valuable clues to the structure of the earth's deep interior, and can be used to detect underground atomic explosions.

The Gravity Division is working to complete gravity measurements for the land mass of Canada as well as the adjacent continental shelves. The result of these studies is information about the thickness and composition of the earth's crust. Much of this work is carried out on field trips with portable gravity meters. The division also studies earth tides.

In order to keep track of the slow changes in the direction and intensity of the geomagnetic field, the Geomagnetism Division makes careful measurements every few years at some 100 repeat stations across Canada. There are also a number of permanent geomagnetic observatories. Airborne geomagnetic measurements are carried out with the division's three-component magnetometer which has been flown all over Canada as well as the North Atlantic. Geomagnetic maps are used in mineral prospecting, navigation, and surveying.

The work of the astronomer and the geophysicist is highly specialized and demands a high degree of training. Graduation in physics or mathematics is a good starting point for a career in these fields.

E.M.R.'s radio telescope near Penticton, B.C.

POLAR CONTINENTAL SHELF PROJECT

This branch is unique in that most of its studies are carried out by members of other branches as well as private and government agencies who are temporarily attached to the Polar Continental Shelf Project. The reason for this arrangement is that the work of the branch is carried out entirely in the northern Arctic — mainly in and around the Queen Elizabeth Islands — and the difficulties of transporting and supplying small research groups in that rugged area are best overcome by pooling planes, housing, food, and other equipment under a single management. Most of the type of work carried out by the field units of the department is also represented by the Polar Continental Shelf Project — geodetic, topographic, and hydrographic surveys, geophysical measurements, geological studies of the land and sea bottom, glaciology, and oceanography. The bulk of the field work is done during summer, and occupies about 90 persons.

A surveyor takes a reading on the Polar Continental Shelf Project.

WATER

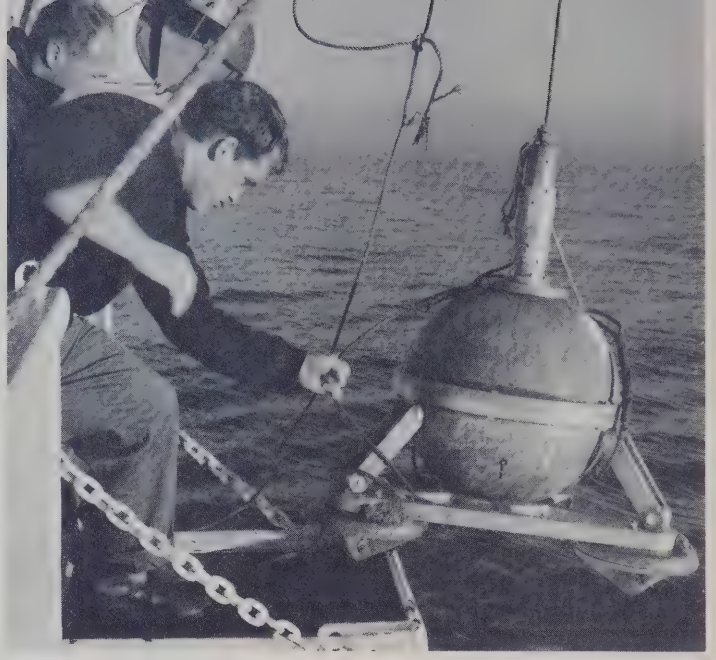
MARINE SCIENCES

The Marine Sciences Branch surveys and produces charts of Canada's navigable rivers, lakes, and surrounding seas, and carries out oceanographic studies. To fulfill these tasks, the branch is divided into the Canadian Hydrographic Service, the Division of Oceanographic Research, and the Ship Division. The head office of the branch and the chart-production units are located in Ottawa. To carry out its operations, the branch maintains the Atlantic Oceanographic Laboratory in the Bedford Institute at Dartmouth, Nova Scotia — a complex of laboratories, offices, machine shops, and docks — and smaller field establishments at Victoria, B.C., and Ottawa. It operates a fleet of twelve ships, of which six are based at the Bedford Institute and five at Victoria, and some one hundred surveying launches which operate either independently or from ships. Their survey work has taken Marine Sciences ships as far afield at the Arctic Ocean, the Caribbean, and the eastern Atlantic.

Broadly speaking, oceanography is concerned with the sea's physical and chemical characteristics. Such a study would not be complete without taking into account marine biology, submarine geology, and the interaction of sea and weather. The complicated chemical structure of sea water is especially interesting to oceanographers, both in respect of organic and inorganic compounds and the interaction between them. The presence of natural and artificial radioactivity, the distribution of heat and density of layers of ocean water, the strength and variation of ocean currents throughout the entire depth of the ocean, underwater acoustics, the stress of wind on the sea surface — all these are receiving close attention from the department's oceanographers.

The findings of oceanographic research are valued and used by many other sciences and practical pursuits: fisheries research, submarine warfare technology, meteorology, harbor construction and other types of seaside engineering, geology, and, of course, navigation.

For a career in oceanography, university graduation with specialization in mathematics, physics, chemistry or engineering is a good starting point. In addition to the foregoing, post-graduate training in oceanography is an essential requirement. Oceanographer trainees are given operational training at sea and ashore, and are assisted in obtaining postgraduate training by educational leave.



This gravimeter, lowered to the floor of Hudson Bay will measure the pull of the earth's gravity at sea bottom.

Hydrography originated in the need for maps specially designed for the use of the mariner. Marine surveys are undertaken to produce navigational charts which are, in essence, complete, accurate and intelligible representations of the areas portrayed. All topographical features which may be of value to the mariner in helping him to recognize the coast and to determine his position, as well as lighthouses, buoys and other navigational aids, are shown on the chart.

The work of the hydrographic surveyor includes many branches of hydrology; no two surveys are identical and new problems to test the hydrographer's skill and ingenuity are constantly encountered.

Owing to the constant movement of water, hydrographers must also observe and record tides, currents, the presence and movement of ice, the formation and erosion of sandbars and the changes of water levels in our inland lakes.

Pride of the hydrographic fleet: The BAFFIN in Arctic Waters.

In addition to charts, the Canadian Hydrographic Service publishes fourteen volumes of *Sailing Directions* covering all Canadian coastal and inland navigable waters. These volumes, besides supplementing the information shown on the chart, describe the facilities available in ports and harbours and contain detailed instructions for navigating intricate passages. Tide tables containing tidal information for all coastal ports and harbours of Canada are also published by the Canadian Hydrographic Service.

Qualifications for professional hydrographers are similar to those of topographical and legal surveyors, with an emphasis on the knowledge of navigation.

INLAND WATERS

The Inland Waters Branch carries out scientific research and engineering investigations of Canada's freshwater resources. It is concerned with the quality and quantity of those resources so that the most effective use can be made of them.

The branch maintains an extensive network of some 2,200 gauges on Canada's lakes, rivers, and seacoasts to measure streamflow and water levels. Some of the data go back more than half a century and each year new gauges are added. At some of these gauge sites, additional information is collected — there are 80 stations where the sediment load carried by the rivers is measured; 140 stations where water-quality samples are taken.

The information obtained at these stations is published for use by anyone who may need it.

Branch activities go far beyond the mere collection of data, however. Samples of water taken are analyzed in laboratories operated by the Branch. Analysis of sediment contained in rivers allows predictions to be made of the effect of structures which may be built on those rivers — for instance, whether or not a reservoir will be rendered useless by the deposition of silt. Increasing attention is being given to the problem of pollution — both natural and manmade — its measurement and control. Studies of boiler-water treatment, the monitoring of mine waste in streams and its effect on fish — these are examples of the types of investigations carried out.

Engineers of the branch study and make recommendations on requests for federal assistance from provinces that wish to build dykes, dams, and other structures to control or conserve water. They participate in studies of entire river basins to determine the best means of making use of the water. The branch had a large part in the studies and the negotiations leading to the Columbia River treaty, whereby the water and power potential of that river will be developed to the benefit of Canada and the United States.

Studies of the Saskatchewan-Nelson system, embracing the three Prairie Provinces, will lead to a complete knowledge of this river system and assess the feasibility of reservoirs and diversions from other basins.

Another example is a program of field investigations and related office studies of diversion schemes for the rivers of northern Ontario.

Among the most critical problems facing Canada is the pollution of lakes and rivers in areas of population concentration and industrial activity. The region around the Great Lakes is one such area. At Burlington on Lake Ontario the branch is building the Canada Centre for Inland Waters, where facilities will be provided for an intensive investigation of the Great Lakes, primarily directed toward alleviation of their pollution. Research carried out here will be applicable in all parts of Canada. Studies will be made of the physical, chemical, and

geological processes taking place in the waters and bottom sediments of the lakes. The Centre will be equipped with laboratories, ships, launches, and other major equipment necessary to these studies.

Meanwhile an intensive program of research is underway at the branch's temporary quarters at the site.

All these activities are related to Canada's surface-water resources. But the huge, mostly untapped, and largely unknown quantities of water beneath the land surface are not forgotten. Hydrogeologists study the occurrence, source, movement, and chemistry of groundwater. By studying its geological history, scientists are attempting to forecast long-term changes.

Glaciology represents another facet of branch activities. A complete inventory of Canadian glaciers is being compiled. Studies are carried out to evaluate the importance of glaciers in the hydrologic cycle. Glaciers in the Arctic islands and the Cordillera are receiving special attention. Ice flow, accumulation and melting rates are some of the phenomena being studied.

Besides these activities, the branch is responsible for the coordination of Canada's participation in the International Hydrological Decade (1965-74) during which 100 nations are carrying out projects and obtaining information relating to the availability, quality, and movement of water in the continental areas all over the world. Besides providing the secretariat of the Canadian National Committee for the International Hydrological Decade, the Branch participates in many of the projects.

Staff members of the Inland Waters Branch may find themselves stationed, permanently or temporarily, in many parts of Canada. For a professional career the best foundation is a degree in engineering, physics, chemistry, geology or mathematics.

Temporary quarters for the new Canada Centre for Inland Waters, Burlington, Ontario.

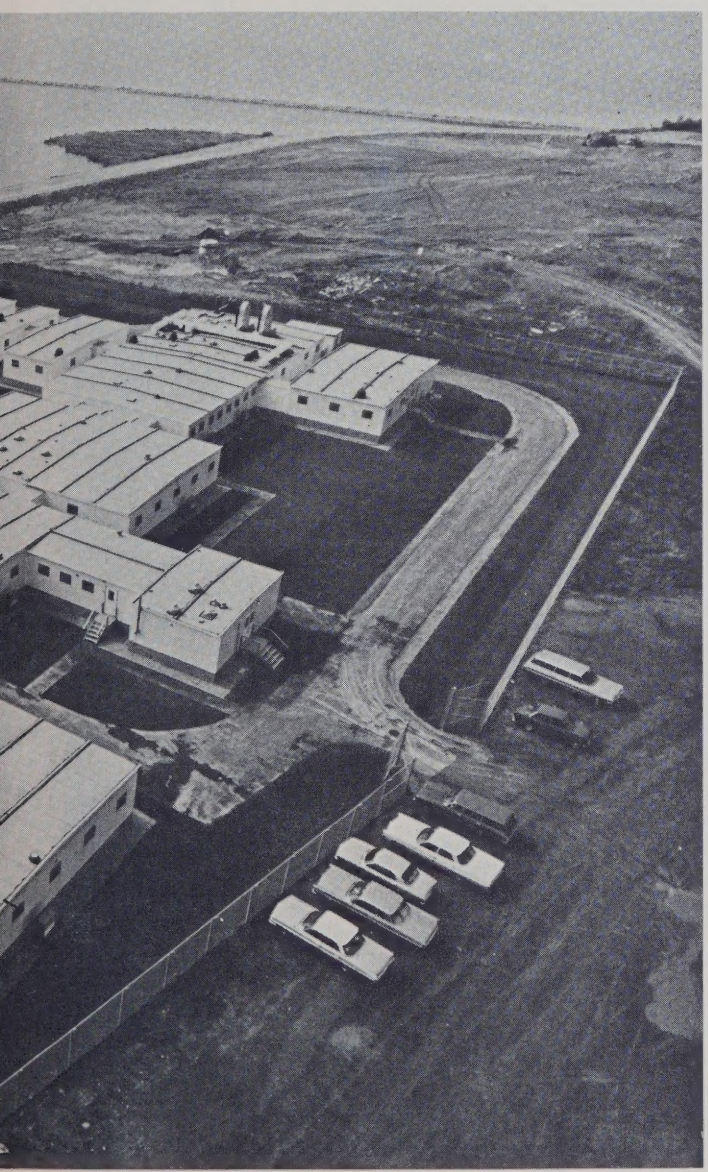
POLICY AND PLANNING BRANCH

Unlike the Marine Sciences and Inland Waters branches, the Policy and Planning Branch of the Water Group does not have its major interest in scientific field research but concerns itself more with the formulation of policy, with the preparation of comprehensive plans for the development of water and related resources and with research on the broad jurisdictional, technical, economic, and social implications of water use.

An important function of the branch is liaison between the numerous government agencies, federal and provincial, that share in the administration of Canada's water resources. It consists of three divisions: Policy Advisory, Co-ordination and Administration; Resource Planning; and Resources Research. They review existing agreements between the federal government and the provinces concerning water use, and make recommendations, where needed, for amendments or new agreements. They also study the economic, social, legal and technical aspects of regional or "basin" projects for flood control, regulation of water supply, pollution abatement, diversions, and so forth. Research is directed toward the best use of the national resources of Canada through integration of existing knowledge in the economic, sociological, scientific and technological fields.

Examples of the work done in the branch are: the co-ordination of federal government preparations for the National Conference on Pollution and Our Environment which was held in Montreal in 1966; the development of proposals for federal and federal-provincial programs arising from the guidelines produced by that conference; arrangements for Canadian participation in the International Conference on Water for Peace held in Washington in May 1967; participation in the Northern Ontario Water Studies which concern the conservation, storage, regulation, diversion, and hydroelectric development of several major rivers draining into Hudson Bay; a survey of the urban structure of the Atlantic Provinces; administration of grants in aid of university research on water; and the drafting of a new Canada Water Act.

Because the branch is interdisciplinary in concept and structure, there are attractive opportunities through a broad spectrum for those with professional training in the resource field, in economics, statistics, engineering, and the social sciences.



MINERAL DEVELOPMENT

MINERAL RESOURCES BRANCH

The work of the Mineral Resources Branch is concerned with mineral resources, mineral economics, legislation for and taxation of the Canadian mineral industry, and administrative tasks.

It conducts fundamental and applied resource-engineering-economic research and field investigations into problems affecting non-renewable resources, policies and programs, on a regional, national and international basis. The officers of the Branch advise their colleagues in other government departments and agencies on policies and developments pertaining to the mineral industry in Canada and abroad that might affect the industry and ought to be taken into account in policy-making. To this end, they collect and analyze a wealth of data on minerals, ores and fuels; on mining and oil companies; on the technical and economic aspects of exploration, development, production, transportation and use of minerals and their products; and on existing or proposed legislative and tax measures. This information, in addition to being utilized in the formulation of policy advice, also forms the basis of the Branch resource-engineering-economic reports and of its comprehensive system of mineral resource records.

The Branch administers the Emergency Gold Mining Assistance Act and maintains a small staff to carry out the engineering inspections of all gold mines receiving assistance under that act.

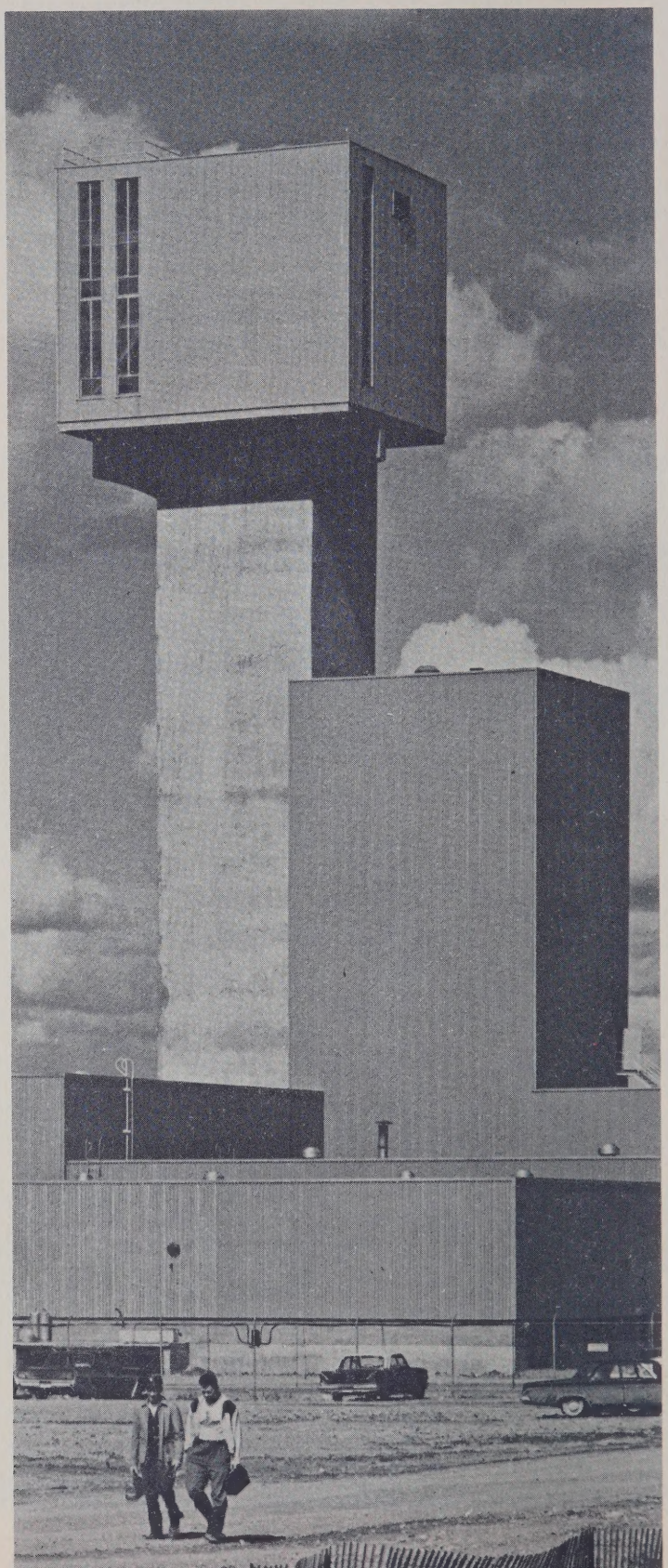
Among the interesting tasks carried out by the Mineral Resources Branch are the coordination and direction of the foreign-aid activities of the Department and participation in the work and meetings of the various international organizations concerned with non-renewable resources.

The Branch employs mineral economists and mining, metallurgical and petroleum engineers with education and/or experience in mineral economics or economics.

EXPLOSIVES DIVISION

The small Explosives Division is a self-contained agency whose job it is to ensure proper safety in the manufacture, sale, storage, importation, and highway transportation of explosives and fireworks.

The Division administers the Canada Explosives Act, and pursues its work along two lines: (1) by analyzing and acting upon the results of tests carried out by the Mines Branch on newly introduced explosives; and (2) by inspecting explosives factories and warehouses. Division officers also investigate the causes of accidents and conduct a publicity campaign to point out the dangers of carelessness in the storage or highway transportation of explosives.



ENERGY DEVELOPMENT

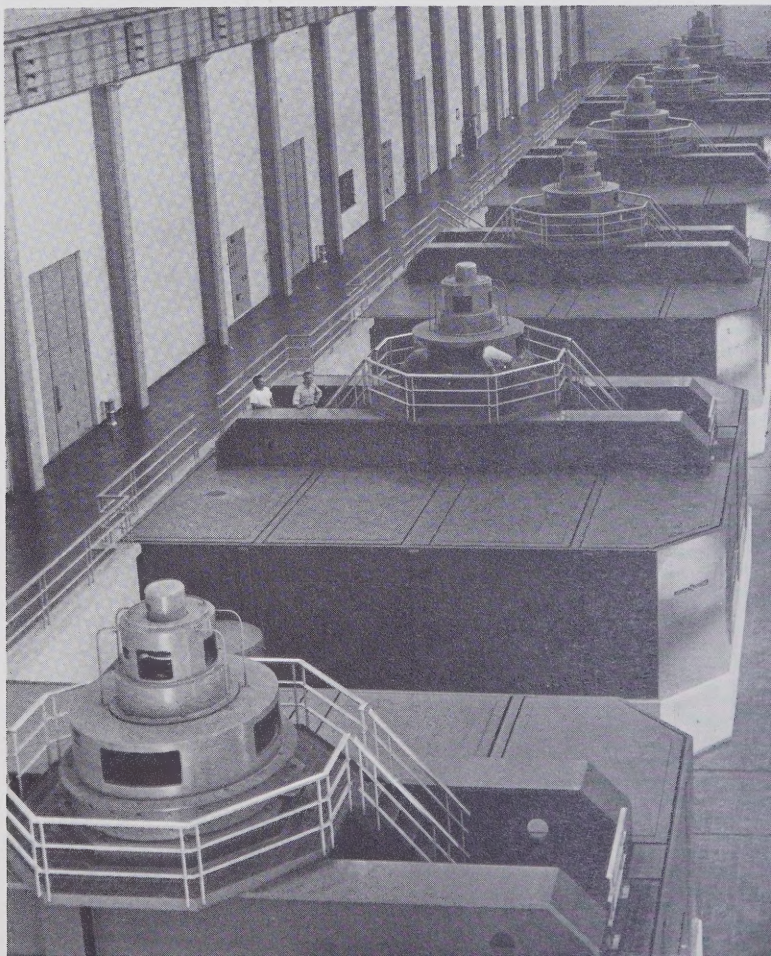
The Energy Development Group, still in the process of formation as this is written, collects information and makes recommendations to the Minister on energy matters and energy policy. This pertains in particular to the several Crown companies and agencies in the energy field. The group also examines the various forms and sources of energy — coal, oil, gas, hydro-electric and nuclear — and makes sure that national policies are co-ordinated in the most effective and economic fashion. Examples of such federal efforts in the field of electricity are the participation, with the provinces of Nova Scotia and New Brunswick, in the study of the tidal power potential of the Bay of Fundy; the federal-provincial agreement on the Nelson River power development whereby the federal government will build a 600-mile transmission line costing $170,000,000 and lease it to Manitoba Hydro; participation in the control bodies for the proper implementation of the Columbia River Treaty; and the study of the proposed trans-Canada transmission grid.

The Energy Development Group also contains the Resource Administration Division, which administers and manages the federal interest in mineral resources offshore from Canada's east and west seacoasts and in Hudson Bay, as well as certain federally owned mineral rights in the provinces. In fulfilling these functions, the division issues licenses, permits, claims and leases to operators and regulates the manner in which exploration and exploitation are carried out in lands not under provincial jurisdiction. The overwhelming majority of these activities pertain to offshore oil exploration.

The areas off Canada's coasts under the administration of the division total 870,000 square miles, equal to almost a quarter of the total area of Canada. In mid-1968, well over a half of this total was leased to private companies for exploration for oil and gas.

As part of its responsibilities, the division keeps in touch with other government agencies and exploration companies so that all concerned will be aware of current activities and the various regulations and requirements governing them. Division personnel are also involved in a wide range of policy considerations of national and international import associated with offshore areas.

There are excellent opportunities in this new and growing scientific-administrative unit for economists and engineers, and there is also a place for statisticians and geographers.



Department of Energy,
Mines and Resources

J. J. Greene, Minister
C. M. Isbister, Deputy Minister